SCURVY, THE COSMIC CONNECTION:

AN ANCIENT SUPERNOVA AND THE PRACTICE OF MEDICINE IN THE TWENTIETH CENTURY

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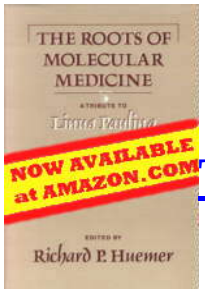
Chapter 3 from the book



THE ROOTS OF MOLECULAR MEDICINE: A TRIBUTE TO LINUS PAULING

One of the most important medical events of the twentieth century thus far has been the discovery (by Albert Szent-Gyoergyi), synthesis, and inexpensive commercial production of ascorbic acid. This compound has been identified as the human liver metabolite which, when missing, is responsible for scurvy. After about 1940 and certainly after 1967, for the first time in history and 65 million years of human prehistory,[1-4] it became possible to cure and eliminate scurvy by giving the required (many grams) daily doses of ascorbate.

Yet the pandemic of chronic sub clinical scurvy (CSS syndrome)[5] continues to afflict humans in the twentieth century.[6] The efforts of nutritionists to stem it have been hindered by prescription of grossly inadequate daily intakes of ascorbate, based on the incorrect and outdated guidelines of the "vitamin C dietary deficiency disease" hypothesis.[7] Unless current human RDAs[8] for ascorbate (vitamin C) are drastically increased to correspond with daily amounts found to be normally synthesized in the livers of nonprimate mammals under various degrees of stress, mankind risks extinction. A lifetime of CSS compounded by the stresses of living in the modern, overpopulated world (increasing deterioration and pollution of air, water, and foodstuffs) recreates a physiological insult that may place Home sapiens among this planet's endangered species. This intelligent primate must control its evolutionary destiny and convert itself into the more robust human subspecies, Homo sapiens ascorbicus.[9-11] Otherwise, its continued survival in this hostile, polluted world is in question.

THE DAWN OF ASCORBIC ACID

Speculations and conclusions on the evolutionary natural history of ascorbic acid were published in 1972.[4] That treatise essentially took the reader on a speculative tour of billions of years back in time, using as a spaceship the trained human mind. This is a safe and convenient way to travel because the vehicle is not subject to the usual physical limitations of the speed of light or the irreversibly of time; it is inexpensive, weightless, and requires no shielding against the hazards of outer space. The first landing was at a point when the primitive living process was just beginning to evolve. There were no sharp distinctions then between plants and animals. Photosynthesis, the means for

storing the sun's energy as carbohydrates, had been in operation successfully for a long time. The earth was a green haven where the land and the waters were covered with cells containing chlorophyll that converted atmospheric carbon dioxide and water into glucose, the main source of food and energy for the living process.

The atmosphere in those days was quite different from what it is today. The living process developed in an essentially oxygen-free atmosphere. Today the atmosphere contains about 20 percent oxygen, which is a by-product of the chemical reactions of photosynthesis. Early life forms produced so much oxygen that the atmosphere gradually changed from a reducing to an oxidizing one. This oxygen was toxic to living cells, creating the planet's first air-pollution crisis. The situation threatened to kill the living cells that had been so successful up to that point.

Nature developed ascorbic acid to save the living process from extinction. This same procedure occurred many times in subsequent evolutionary crises, so that ascorbic acid became, in a sense, the favorite evolutionary life saver. Nature developed four enzymes to convert the abundant glucose product of photosynthesis into ascorbic acid. These four enzymes were similar or identical to the four-enzymes system being used by present-day plants and animals.

Ascorbic acid was first used as a detoxicant to counteract the increasing toxic levels of oxygen in the atmosphere. It is a member of the labile oxidation-reduction system (ascorbic acid-dehydroascorbic acid), and it functions by buffering the oxidation-reduction potential of living cells at the proper, optimum, low pH values. The higher the concentration of ascorbate in the living

cell, the better is the cell's buffering capacity. In this way, ascorbic acid protects all plants and animals against the high concentration (now stabilized at about 20 percent) of toxic oxygen in our atmosphere.

ASCENT OF THE VERTEBRATES

About 425 million years ago, Nature began a major experiment, which resulted in the evolution of the vertebrates. Comparing the biochemical physiologies of present and ancient vertebrates can lead to some educated guesses and interesting conclusions on how problems of survival were solved during the evolution of increasingly complex animals.

The fish were the earliest vertebrates. Amphibians, about 325 million years ago, started their lives in the waters and then adapted to dry-land living. Reptiles, mostly terrestrial forms although some returned to waters, arose about 205 million years ago. These three groups were cold-blooded creates: they had no internal mechanism for maintaining a uniform body temperature, and hence their metabolism tended to be sluggish at times. The next two groups, the warm-blooded birds and mammals, arrived about 165 million years ago.

The amount of ascorbate produced each day in the modern vertebrates increases as we go up the evolutionary scale. The largest increase is found in the step between the cold-blooded, sluggish reptiles and the warm-blooded, highly active mammals.

Amphibians and reptiles synthesize ascorbate in their kidneys. The locus of ascorbate-producing enzymes in present-day mammals is the liver. This change in site appears to have an evolutionary importance. When the warm-blooded, highly active, and highly stressed mammals came into existence, the problem arose of how to provide them with enough ascorbic acid each day to act as an antistressor and to maintain biochemical homeostasis in their unusually high rate of metabolism. The problem was neatly solved in early mammals by the transference of the site of ascorbate synthesis from the small kidneys to the liver, the largest organ in the mammalian body. An additional safeguard was provided by the development of a biochemical feedback mechanism that increased the liver production of ascorbate in accordance with incident stress.[12]

These changes assured not only the survival of the mammals for the next 165 million years, but also their world dominance. Modern nutritionists and physicians should note that those early mammals that did not make this kidney-to-liver transfer became extinct because they were unable to produce the daily dose of ascorbate required for survival.

The present-day birds provide living examples of this kidney-to-liver transfer of ascorbate synthesis.[13] The oldest evolutionary species produce ascorbate in the kidneys; the intermediate species produce in both kidney and liver, and the most recent, the song birds, produce only in the liver. Some tropical birds, like the red-vented bul-bul, have the same genetic defect as humans and cannot make any ascorbate. They are among the few types of birds that can die of scurvy.

AGE OF THE PRIMATES

About 70 million years ago mammals were thriving as long as they kept out of the way of the dinosaurs, which flourished on the land, in the waters, and even in the air. Nature was ready to launch another extended experiment that would culminate 60 or 70 million years later with the appearance of subhuman hominids and finally Homo sapiens. It was about this time that some evolving mammals developed advantageous primate characteristics. These early primates looked more like squirrels than monkeys, but they were the beginning of a major group of mammals that would form the two present-day primate suborders, the Prosimiae and the Anthropoidea. The next several million years would be times of great adversity and stress, not only for the evolving primates, but for all form of life on Earth.

About 65 million years ago a catastrophe occurred that had mixed consequences for primitive primates. This is the "cosmic connection" that so greatly affects present-day health, longevity, and practice of medicine. There are at least two hypotheses about what happened. The supernova theory of Russell and Tucker[14] states that there was a supernova explosion in a nearby galaxy; the Earth was showered with large fluxes of high-energy radiation, which caused extensive damage. The second hypothesis, by Alvarez et al.,[15] blames the holocaust on the impact of a large asteroid. I support the supernova theory because it accounts for the high-energy mutagenic radiation needed to cause the conditional-lethal mutations that occurred in the evolving primates.

Whatever the cause of this cataclysm, the results were the sudden disappearance of the dinosaurs, great changes in the worldwide distribution of fossil invertebrates, and mutational destruction of the gene for the liver enzyme L-gulonolactone oxidase, as well as the possible similar loss of the enzyme uricase from the primate line.* The changes were good for the primates in that they could now evolve without competition from the dinosaurs. They were bad because the mutated mammals were handicapped by the loss of essential enzymes. They survived at great cost in lives, sickness, and misery, and the genetic defects still affect the lives of humans today.

EARLY RESEARCH ON SCURVY

Scorbutic prehistory and early history of Homo sapiens has been described elsewhere.[16] But let us now skip to a point in the eighteenth century to evaluate the early outstanding figure in scurvy research, Dr. James Lind. During the winters or early springs of the eighteenth century, scurvy weakened and reduced the population. Every baby was born after a 9-month intrauterine bout with scurvy, and most infants died in their first year from the scurvy-induced sudden infant death syndrome (SIDS).[17] Many that survived the first year succumbed before the fourth year because they lacked resistance to infections and other diseases, owing to scurvy-induced defects in the human immune system. It was a rare, hardy individual who managed to stay alive after his or her twentieth birthday.

Folk medicine vaguely related scurvy to the lack of fresh vegetation, but we know now that even the best of diets will not "cure" scurvy. It is likely that the

early development of the human female's sexual trait of copulation at any time without estrus prevented the extinction of Homo sapiens; it provided a means of supplying new individuals at a slightly faster rate than scurvy killed them.

James Lind (1716-1794) of Britain's Royal Navy, the "Father of Nautical Medicine," became interested in scurvy on shipboard. He devised the protocol of and conducted the first scientific, controlled test for the treatment of scorbutic sailors. Lind showed that an orange or a lemon, fed daily to scorbutic sailors, would delay the onset of terminal symptoms of scurvy so that sailors could stand their watches and man the ships. He published his results in 1753,[18] and they have been misinterpreted until today.

At the beginning of the twentieth century, Lind's results were distorted into the nutritionists' belief that something in a single orange or lemon had the power to prevent or cure scurvy. Additional work in the early years of the twentieth century[19] prompted the publication of Polish chemist Casimir Funk's seemingly logical explanation of the scurvy phenomenon, the "vitamin C dietary deficiency disease" hypothesis.[7] This hypothesis, published some 20 years before the discovery of ascorbic acid, dominated the thoughts and actions of nutritionists for the next seven decade, up to the present time. Nutritionists have become so attached to the hypothesis that they have been unable to realize, even after 1967,[1-3] that in 1912 they set for themselves the impossible task of treating a deadly, liver-enzyme, genetic disease by the ineffectual methods of home economists. The medical profession adopted this theory so long ago that is has become established dogma.[20] The low daily dosage of ascorbate inherent in any "vitamin" theory has made the seven decades of work by nutritionists into a major blunder of twentieth-century medicine.[21]

In 1959, the biochemist John J. Burns showed that scurvy resulted from the absence of the enzyme L-gulonolactone oxidase (GLO) in the human liver.[22] GLO is the last enzyme in the series of four used by the mammals to convert blood sugar (glucose) into ascorbic acid. In the absence of GLO, this important synthesis is halted, and the potential for scurvy plagues Homo sapiens.

A PERSONAL EXPERIENCE

A year after Burn's crucial discovery, my wife and I were involved in an accident that nearly cost us our lives. The accident was serendipitous in that it provided insights into human physiology in the scurvy-free condition.

The experiment began when a drunken driver crashed her car head-on into mine on a South Dakota highway. My wife and I were severely injured; no accident victim with injuries as severe as ours had survived at the hospital to which we were transported. The emergency room doctors and nurses did not expect me to survive the first night. They could not understand why my wife and I were conscious and lucid, and not in a state of deep shock from the trauma, severe bone injuries, and blood loss.

Since the 1930s we had been taking on a regular basis gradually increasing megadoses of ascorbate. By 1960 our dose was up to 5 to 10 g daily, or more if we were under heavy stress. One of the physiological effects of megadoses of

ascorbate is the prevention of shock, the physiological response that kills the severely injured accident victims.

Our bodies were scurvy-free, and we tried to remain scurvy-free during our 2 3/4 month hospital stay by taking about 60 g of ascorbate daily. The hospital had never had patients like us before. From the start we began disproving all the medical prognostications based on scorbutic patients. Our physiology was more robust than that of the usual scorbutic hospital population. I healed so rapidly that I was able to walk out of the hospital on the broken legs that doctors had said could not bear my weight for at least a year. I have no doubt that without ascorbate, our lives would have ended on the night of the accident.

I also made the observation that patients entering a hospital do not necessarily die of the disease for which they entered. Scurvy is so rife in hospitals that it is probably involved in every hospital death. Subclinical scurvy is rampant not only among patients, but among doctors, nurses, and other individuals who limit their ascorbate intake to 60 mg daily. Tests on the urinary spillover of ascorbate establish the correctness of this observation.*

Four and a half months after the accident, I returned to work, convinced of the necessity of immediate publication of my work on the genetics of scurvy. I found out, the hard way, that it was much easier to conduct the research and write the paper that it was to have it published in an orthodox medical journal. I went through the routine of submitting the manuscript and having it rejected by six medical journals before it was finally published in 1966.[1]

GAINING CREDIBILITY

Publication of the research data was not the only problem; convincing medical professionals to initiate clinical trials with megadoses of ascorbate was even more formidable. Because available information indicated that the viral diseases were likely to be successfully treated by megadoses of ascorbate, my first approach was to try to interest the National Institutes of Health in investigating ascorbic acid as a nontoxic, nonspecific virucidal agent. Literature of the 1930s indicated the inactivation of viruses by ascorbate;[24] the pioneering work of Dr. Frederick R. Klenner showed that megadoses of ascorbate were successful in treating viral disease,[25] and my anecdotal studies suggested that a two-phase, megadose ascorbate regimen prevented or aborted the common cold with over 95 percent success. However, in all my attempts I have never succeeded in inducing a publicly or privately supported research foundation to test megadose ascorbate therapy clinically. Orthodox medicine has failed to recognize the importance of the "cosmic connection."

IN GRATITUDE TO DR. PAULING

Thus was the situation regarding megadose ascorbic acid therapy in the years before Linus Pauling. Through the efforts mainly of Dr. Klenner and myself, the new medical modality was struggling against the well-financed hostility and

studied indifference of orthodox nutritionists and their medical colleagues. The entry of Dr. Pauling into the arena was the impetus that proponents of this field needed to bring these revolutionary concepts to the millions of people who are now benefiting from improved general health, greater resistance to disease, and a longer, healthy life span. No other person but Dr. Pauling could have accomplished this.

Orthodox medicine regarded the 1970 publication of Vitamin C and the Common Cold[26] and its favorable public reception as an unwarranted incursion by a nonmedical worker into their sacred, exclusive territory. The protocols of the large-scale test they proceeded to set up where designed to show that the procedure would not work and that Dr. Pauling was wrong. They used daily doses too low to be effective and in most tests did not include the important abortive phase of this two-part procedure; they only carried out half a test. Those who did try to include an abortive phase lacked understanding of the size and proper timing of the ascorbic doses. The result, predictably, was a fiasco, and physicians wrongly deduced that the two-phase, common cold treatment was ineffective. However, millions of citizens who had read Dr. Pauling's books [26,27] and were concerned about their health, conducted "anecdotal" tests of their own and found their well-being and resistance to the common cold greatly improved.

Cameron and Pauling's 1979 book[28] showed the usefulness of ascorbic acid in cancer therapy. This is to be expected because all cancer cases are complicated by the "cosmic connection" - CSS that oncologists fail to correct. I fully agree with Dr. Pauling when he states that "in the not too distant future, supplemental ascorbate will have an established place in all cancer treatment regimes." In the

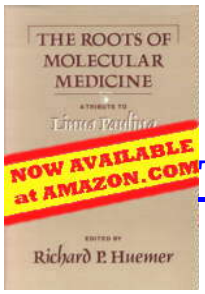
meantime oncologists will be faced with hundreds of thousands of terminally ill cancer patients who must be told that they are beyond hope and near death. Orthdox medicine can offer little to these pathetic victims of the "cosmic connection," but I believe that orthomolecular medicine can rescue many of them from their misery and death.

In conclusion, I would like to acknowledge the great debt I owe to Linus Pauling. He gave the first and only encouragement I needed in the 1960s for a chemical engineer and biochemist to continue working with a revolutionary concept in the unfamiliar and often hostile field of medical genetics. I am proud to call him my friend. In a larger sense, he is a friend to all human beings. For his achievements in improving human health, we are all in his debt.

REFERENCES

See the book

Chapter 3



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